

munity generally. In the Abbey he has joined a noble company of departed worthies—Newton, Herschel, Lyell, Spottiswoode, Darwin—names that perpetuate some of the most glorious and imperishable achievements in natural knowledge. Especially gratifying must it be to the Royal Society to feel that the remains of their illustrious past-president find a resting-place side by side with those of Sir Isaac Newton.

The representative gathering that filled the Abbey on Monday, December 23, afforded ample testimony to the wide and varied interests, apart from pure science, that dominated the career of Lord Kelvin. Not only a brilliant moving figure in the hierarchy of science, he was also a great citizen, ever mindful of the best traditions of English public life.

The funeral service, which commenced at noon, was of the most impressive character. The King was represented by His Grace the Duke of Argyll, K.G.; the Prince of Wales by Lt.-Col. Sir Arthur Bigge, G.C.V.O.; and the Duke of Connaught by Major L. Green-Wilkinson. The Princess Louise (Duchess of Argyll) was present, attended by a lady and gentleman in waiting. Seats in the choir stalls were occupied by:

Lady Rayleigh, the Russian and Italian Ambassadors, Mr. J. Ridgely Carter, representing the American Ambassador; Baron von Stumm, representing the German Ambassador; and Mr. Ijiuin, representing the Japanese Ambassador; the Lord Mayor of London (who was robed), and the Master of the Clothworkers' Company. The First Lord of the Admiralty, Lord Tweedmouth, accompanied by his secretaries, attended to represent the Board of Admiralty. The Lord President of the Council was represented by Mr. Almeric FitzRoy.

At the Chapter House a procession was formed, which, headed by the choir and officiating clergy, slowly wended its way from the Chapel of St. Faith through the cloisters, and, while the hymn "Brief life is here our portion" was being sung, to the nave, and thence to the lantern, beneath which the coffin was temporarily deposited. The order was as follows:

Clergy and choir; bier; pall bearers; chief mourners; Institute of France, M. G. Lippmann, For.Mem.R.S., M. Henri Becquerel, in addition to M. Darboux, For.Mem.R.S., perpetual secretary, who took part as a pall bearer; Lord Mayor of London; Master of Clothworkers' Company; the Royal Society; the Royal Society of Edinburgh and other British and foreign learned societies; Universities of Cambridge and Oxford; University of Glasgow and other Glasgow delegations; University of Edinburgh and Corporation of Edinburgh; other British universities.

A guard of honour of the Electrical Engineer Volunteers, of which Lord Kelvin was Colonel-in-Chief, lined the cloisters, Colonel R. E. B. Crompton, C.B., commanding. The guard fell in at the end of the procession, and took up a position in the nave.

The pall bearers and chief mourners were as subjoined:

Pall Bearers.

Lord Rayleigh, O.M. Sir Edward H. Seymour, (President of the Royal O.M. (Admiral of the Fleet). Society). M. Gaston Darboux, For.Mem.R.S. (Perpetual

Mr. J. Morley, O.M. Secretary of State for India). M. Gaston Darboux, For.Mem.R.S. (Secretary of the Paris Academy of Sciences).

Sir Archibald Geikie, K.C.B., Sec.R.S. (President of the Geological Society). The Lord Stratford and Mount Royal (High Commissioner for Canada).

Prof. A. Crum Brown, F.R.S. (Royal Society of Edinburgh). Sir George Darwin, K.C.B., F.R.S. (University of Cambridge).

The Master of Peterhouse, Cambridge (Dr. A. W. Ward). Dr. MacAlister (Principal of the University of Glasgow).

Sir J. Wolfe-Barry, K.C.B., F.R.S. (Institution of Civil Engineers). Dr. R. T. Glazebrook, F.R.S. (Institution of Electrical Engineers).

Chief Mourners.

Dr. J. T. Bottomley,	Mr. James Thomson.
F.R.S.	Mr. W. Bottomley.

Mr. G. King.	Sir Alex. Brown.
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Mr. W. Crum and two others, with four grand-nephews, Mr. D. King, Mr. J. F., Mr. W., and Mr. G. Bottomley.
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On the part of the Royal Society, in addition to pall bearers and other Fellows who also represented universities, there were present Mr. A. B. Kempe (treasurer), Prof. Larmor (secretary), Sir W. Crookes (vice-president), Sir J. Stirling, Sir John Evans, Major MacMahon, &c., and Mr. R. Harrison (assistant secretary).

It is unfortunately impossible to find space here to print the long list of representatives of British universities, scientific societies, and institutions present at the funeral, and we are only able now to state that the following foreign societies were represented in addition to the Paris Academy of Sciences already mentioned:

Imperial Academy of Sciences of Vienna, Lord Rayleigh; Accademia dei Lincei, Rome, Sir Norman Lockyer, Prof. J. J. Thomson, Sir David Gill, and others; the Elektrotechnischer Verein of Berlin, Mr. A. Siemens; Società Italiana di Fisica, Associazione Elettrotecnica Italiana, and Phys. Verein Frankfurt a.M., Prof. Silvanus P. Thompson, &c.

NOTES.

We announce with deep regret the death of Dr. Janssen, director of the Meudon Astro-Physics Observatory, at eighty-three years of age.

A REUTER message from Copenhagen states that experiments made by the Amalgamated Radio-Telegraph Company of London and Copenhagen, owners of the Poulsen system of wireless telegraphy and telephony, show that wireless Poulsen telegrams between Newcastle and Copenhagen and Berlin and Copenhagen can be written directly from the receiver with ink as in the case of telegraphy by wire.

THE Royal Statistical Society's Guy medal in gold has been presented to Prof. F. Y. Edgeworth for his services to statistical science.

DR. THOMAS ANNANDALE, Regius professor of clinical surgery in the University of Edinburgh, died on December 20 at sixty-nine years of age.

ON Saturday next, December 28, Sir David Gill, K.C.B., F.R.S., will deliver the first of the annual course of juvenile lectures at the Royal Institution on "Astronomy, Old and New." The remaining lectures will be delivered on December 31, January 2, 4, 7, and 9.

MR. ELIHU THOMSON, writing from the General Electric Company, Lynn, Mass., U.S.A., comments upon the description of the exhibition of globe lightning in West Australia described in our issue for October 31 (vol. lxxvi., p. 671), and provides particulars of another case brought before his notice by a friend. The phenomenon referred to by Mr. Thomson is said to have appeared as a ball of yellow flame continuously in motion with a central nucleus rose-red in colour, and to have exhibited many points of similarity with the globular lightning seen in Australia on the occasion mentioned in our previous note. From Mr. Thomson's letter it is not clear whether the report made to him relates to globular lightning or to a fireball.

IN the report of the Bristol Museum and Art Gallery for 1907 the committee announces that the success of the combined institution during the period under review has been very pronounced, the total number of visitors considerably exceeding half a million. A new departure is the

installation in the museum of a section devoted to economic biology, galls and gall-flies, together with the various animal and vegetable pests infesting orchards and forests, forming the main exhibits at present before the public.

THE luminiferous properties of the brittle-star, *Amphiura squamata*, and other echinoderms form the subject of an article by Irene Sterzinger in vol. lxxxviii., part iii., of *Zeitschrift für wissenschaftliche Zoologie*. The light is displayed at the summits, and not, as hitherto supposed, at the bases, of the "feet," where it emanates from slime secreted by the epithelium. There is, however, a luminiferous and a non-luminiferous slime. Similar slime-glands occur in certain other echinoderms. Both kinds of slime are soluble in hydrochloric acid.

WE have received a copy of Bulletin No. 72 of the U.S. Entomological Bureau, in which Messrs. W. D. Hunter and W. A. Hooker record the results of investigations into the life-history of the North American fever-tick (*Margaropus annulatus*), and the best modes of keeping the species in check. In parts of Texas and some of the other southern States cattle-breeding is almost impossible owing to this pest, which is estimated to cause an annual loss of one hundred million dollars.

AN important addition to the somewhat scanty literature of galvanising is made by Mr. Alfred Sang, who has published in the Proceedings of the Engineers' Society of Western Pennsylvania an elaborate monograph on old and new methods. The hot process of galvanising dates from Crauford's patent of 1839, and the origins of electrogalvanising, or cold galvanising, as it is often called, are also remote, but commercially it is a new process. In 1902 Mr. Sherard Cowper-Coles patented his process for galvanising metal goods by packing them in zinc dust in an air-tight retort, and heating the retort to a temperature below the melting point of zinc. This process is known as sherardising. The first attempt to coat metals by means of zinc vapour was made by Jean Pierre Chambeiron in 1864. Mr. Sang's investigations on the volatilisation of zinc from zinc dust at low temperatures have led him to important improvements in the vapour process, and there is every reason to hope that this method will soon take its place in the metal industries as a powerful antidote to corrosion. Undoubtedly the proper place to search for further improvements in protective coverings for iron and steel is in the study of the true causes of corrosion.

IN the Bulletin of the Moscow Imperial Society of Naturalists for the year 1906, Prof. E. Leyst, director of the meteorological observatory of that place, contributes an important article on the estimation of the amount of cloud. The matter at first sight would appear to be one of the simplest of meteorological observations, but very few stations are so placed as to have a clear horizon, especially when situated in towns or in valleys. Prof. Leyst has submitted the Moscow observations for several years to a careful discussion, dividing the whole sky into three zones of 30° each. Taking the zenithal zone $60^{\circ}-90^{\circ}$ as the unit of comparison, he finds that in the lower zone the yearly mean of cloudiness is twice as great as in the zenithal zone, and that for the whole of the sky the yearly amount of cloud is 43 per cent. greater than in the zenithal zone, the amounts differing according to the season and to the time of observation. All things considered, the results seem to show that observations of amount of cloud in the zenithal zone are to be preferred; the author also considers that observers should be instructed how to divide the area under observation, so as to estimate cloud in tenths.

THE physiology and habits—the "behaviour," as it is now the fashion to call these factors in the life-history—

of a common American starfish, *Asterias fortieri*, are discussed at considerable length by Mr. H. S. Jennings in a paper issued as one of the zoological publications of California University. The modes by which the creature manages to hold its own in the struggle for existence, the way in which it obtains its food, and kindred subjects, are in turn discussed, and the results of the investigation of all these factors will, it is hoped, afford an insight into the complex life of the sea-shore generally, and manifold inter-relations of the numerous organisms which make this zone their home.

IN vol. xxi., art. 11, of the Journal of the College of Science of Tokyo University, Mr. S. Hatta concludes his account of the gastrulation of the ovum of the lamprey (*Petromyzon*). In the neighbourhood of Sapporo the species during the spring spawning season resorts in numbers to the streams, and thus affords abundant working material, which was developed by means of artificial fertilisation. The author considers that the ovum exhibits a kind of belated development, the blastulation and gastrulation stages overlapping one another, so that what should be the blastula appears to be really an old morula stage. The prime cause of this belated development is indisputably due to delay in segmentation, owing to the accumulation in the ovum of a great amount of yolk.

THE culture of marine fishes and crabs and lobsters in America, by Mr. G. M. Bowers, U.S. Commissioner of Fish and Fisheries, forms the subject of an illustrated article in the November number of the *National Geographic Magazine*. The United States, according to the author, is a long way ahead of any other nation in the matter of marine fish-culture, the only country coming anywhere near it in this respect being Norway, which was, indeed, the pioneer. This, in the author's opinion, is accounted for by the fact that in many countries it is believed to be an impossibility to make any marked increase in the numbers of sea-fishes by artificial culture, as it is seriously to diminish them by fishing. This, however, is far from being the view entertained by the Government of the United States, which carries on fish-culture, and crab and lobster propagation, to an enormous extent in species hatcheries and laboratories. The fishes regularly cultivated—by collecting and artificially fertilising the spawn—are cod, flounders, pollak, and, to a less degree, mackerel, bass, &c., while lobsters are reared at several stations, more especially the one recently established at Boothby Harbour. The general plan of operations is described very graphically by the author.

A MEMOIR by Mr. David Heron on the statistics of insanity and the inheritance of the insane diathesis has been issued by Messrs. Dulau and Co. for the Francis Galton Laboratory for National Eugenics, University of London. The material on which the memoir is based was provided by Dr. A. R. Urquhart, physician superintendent of the James Murray's Royal Asylum, Perth, and consisted of 331 family trees of asylum patients, giving very full details of the brothers and sisters, parents, and in some cases grandparents and children of the patient. The general results are very similar to those of the memoir, previously issued, by Prof. Karl Pearson on pulmonary tuberculosis. The inheritance of the insane diathesis is very marked, the correlation-coefficient between parent and offspring (as calculated by Prof. Pearson's method) lying between the values 0.52-0.62. The figures are bound to be somewhat uncertain, for they involve an estimate of the proportion of the inhabitants of Scotland who have been at any time certified as insane; the census and the Lunacy Commissioners' returns, of course, can only

give the number of patients at a given time or during a given period. Taking the figures for tainted stocks only (pedigrees of asylum patients), 21 per cent. of the offspring were insane when both parents were sane, 24 per cent. when one parent was insane, and 50 per cent. when both parents were insane, the last figure being, however, somewhat doubtful, as it is based on very few cases. There does not appear to be any lack of fertility in the tainted stocks, the mean size of family in 331 families containing at least one insane member being 5·97; eighty-seven matings in which one parent was insane gave a mean of 5·18 children, matings which were not necessarily completed.

MR. T. SHEPPARD, the curator of the Hull Museum, continues his useful work of issuing bulletins at the cost of one penny each, describing the collections under his charge. The most recent issues are devoted to "Notes on the more Important Discoveries in East Yorkshire," and to an account of a British chariot burial discovered during the present year at Hunmanby, in the same district. In the first pamphlet he has collected records of the most notable discoveries, adding useful references to the publications in which they are described. Many valuable relics have passed into other museums or into the hands of private collectors, while several have altogether disappeared. Now that a suitable building has been provided, the collections are rapidly increasing. The British chariot burial at Hunmanby presents many features of interest. The bottom of the grave was occupied by a great wooden shield, apparently of oak, ornamented with thin plates of bronze. The greater part of the woodwork was, unfortunately, destroyed in the landslip which directed attention to the interment. The bones were in a state of decay, but the recovery of two teeth of a horse indicates that the animal was buried with its master. Considerable portions of the chariot were recovered; and while in other Yorkshire burials of this class the bridle-bit is usually of iron coated with bronze, here it is of bronze throughout. The date of the interment is fixed in the first or second century B.C. In more than seven hundred early British burial mounds excavated by Canon Greenwell, Mr. Mortimer, and others, only about half-a-dozen chariot burials were discovered. The "find" at Hunmanby is thus of considerable archaeological importance.

THE first appendix to the *Kew Bulletin* for 1908, being the list of seeds of hardy herbaceous plants and of trees and shrubs available for exchange with botanic gardens and correspondents of Kew, has been received.

PROF. W. TRELEASE contributes to the annual report (No. 18) of the Missouri Botanical Garden a note on the genus *Yucca*, supplementing his monograph published in a former report (No. 13). Under the group of *Sarcococcus* the author revises the species allied to *Yucca valida*, making a new species, *Yucca decipiens*, and indicates their distribution on a map. Characteristic illustrations of *Yucca periculosa*, and a new species, *Yucca Endlichiana*, are given. The latter, sent under the vernacular name of "pitilla," is said to yield good fibre; it is acaulescent, and bears very small, often dark, flowers.

An account of the chemical examination, by Mr. E. A. Mann and Dr. W. H. Ince, of certain West Australian poison plants is published in the progress reports issued as two pamphlets by the Department of Agriculture for the colony. About fifty poisonous plants are said to occur in the State, of which several belonging to the genera *Gastrolobium* and *Oxylobium* are regarded as the most general sources of stock poisoning. One species of each of these

genera was examined, and from each a strongly toxic alkaloid was isolated. The authors also attempted to find an antidote; this, so far as experiments go, is furnished by a preparation of which permanganate of potash is the important constituent.

IN the course of investigations into the nature of Para rubber, Dr. D. Spence was led to examine the constituent, always present, that is insoluble in chloroform or similar solvents. Proceeding from the known occurrence of protein substances in the latex, he comes to the conclusion that the insoluble portion is a protein giving a strong xanthoproteic reaction, and comments on the peculiar fibrous structure shown markedly in sections stained with silver nitrate. This conclusion raises the practical question whether the presence of this insoluble constituent in the latex does not exercise an important physical function in the raw product. The paper is published by the Liverpool Institute of Commercial Research in the Tropics as journal reprint No. 13.

THE Journal of the Department of Agriculture of South Australia for October contains an account of the law relating to certain specified noxious weeds, with popular descriptions of them. Any landowner suffering these weeds to grow on his land, or on the adjoining roadsides, is liable to severe penalties. Should the District Council not enforce the law—and it appears this sometimes happens—the Commissioner of Crown Lands is authorised to have the weeds destroyed, and recover the cost from the council.

THE October numbers of the *Transvaal Agricultural Journal* and of the *Cape of Good Hope Agricultural Journal* have recently come to hand. The former contains an excellent article by Mr. F. B. Smith on agricultural education and research. Mr. Smith's department has been so successful in dealing with agricultural problems, and has appealed so strongly to the Boer farmer, that his plea for a sound and comprehensive system of agricultural education in the Transvaal is not likely to pass unheeded. There are also a number of articles dealing with practical farming matters, and some analyses of Transvaal fodder crops. The Cape of Good Hope has not the advantage of a large agricultural department, and its journal is consequently smaller. Some experiments are described by Prof. Duerden in which the rate of growth of ostrich feathers was found to be $1\frac{3}{4}$ inches per week.

WORCESTERSHIRE fruit growers suffer a great deal from the attacks of the apple sucker (*Psylla malii*), and arrangements were therefore made last year for Mr. Kenneth G. Furley, acting under the supervision of Mr. F. V. Theobald, to visit certain districts and carry out spraying experiments. The results are now issued as a report by the Worcestershire Education Committee. Very few eggs were found on the trees at the beginning of October, though the winged "Psylla" were flying about in great numbers; but about the middle of the month the eggs were thick on the trees, especially on the spurs. The dates of hatching varied; some came out on April 3, while others in the same orchard only appeared on April 10; the blossom and leaf buds were then attacked. Of the various washes tried, the most effective was the mixture of lime and salt recommended by Mr. Howard Chapman. The experiments were evidently well carried out, and the example of the Worcestershire Education Committee might well be followed by others. Considering the enormous losses caused to fruit and hop growers and gardeners generally by insect or fungoid pests, and the great amount of money spent on washes, it is surprising how little systematic work on the subject is done in England.

DR. C. M. LUXMOORE has sent us a copy of his final report on the analysis of one hundred soils from the county of Dorset, preliminary reports upon which, by Dr. Luxmoore himself and by Prof. Percival, have already been issued from the University College of Reading. The soils and their subsoils have been taken from typical localities situated upon all the formations, ranging from the Bagshot Sands to the Lower Lias, which are exposed in the county, and the report contains detailed analyses, both mechanical and chemical, together with certain determinations of their physical constants. In this latter connection one or two novel methods of examination have been proposed, designed to obtain some information as to the behaviour of the soils in the field. In addition to the analytical figures, the report contains a full discussion of the results, in which attempts are made to estimate the interdependence of some of the constituents and the extent to which they may be correlated with the properties of the soil. The report represents a very considerable piece of work, which has occupied Dr. Luxmoore for many years.

IN NATURE of December 27, 1906 (vol. lxxv., p. 197), attention was directed to the remarkable book by Dr. F. Oswald on the "Geology of Armenia." A second edition of this work is now promised; and the author has issued a large lithographed map of the country described, on which the geological features are coloured by hand. This map and an explanatory pamphlet are published by Messrs. Dulau and Co., London (25s. net), and should obviously be secured by those libraries that possess the original work of reference. The country dealt with includes, as a central feature, the great lacustrine and volcanic plain north of Lake Van, and its extent may be judged from the fact that the scale of the map is 1 inch to sixteen miles, and that the sheet measures $37\frac{1}{2}$ inches by $21\frac{1}{2}$ inches. In the pamphlet, which is in itself a guide to the geological structure of Armenia, the striking extent of the marine transgression in early Miocene times is emphasised, the present country being due to Middle Miocene folding, followed by fault-block movements during the Pliocene period.

THE annual report of the State geologist of New Jersey for 1906 (Trenton, 1907) is a volume of 192 pages, containing, in addition to the administrative report for the year, valuable papers on building stones, on the glass-sand industry, on the Triassic copper ores, and on trap rocks for road construction. Mr. W. E. McCourt has made some careful tests to determine the fire-resisting qualities of New Jersey building stones. The crystalline rocks at a temperature of 550° C. were not greatly affected. The gneisses cracked parallel to the banding, and, as a rule, it is safe to assume that a gneiss will be more damaged than a crystalline rock of the same texture and composition without the banding. Clay rocks suffered badly. The sandstones resisted fairly well, while the limestones seem to have suffered the least injury of all the stones tested. The paper by Messrs. H. B. Kümmel and R. B. Gage on the glass-sands of New Jersey shows that they contain more iron, and consequently obtain lower prices at the glass factories than do the Pennsylvania sands with which they compete. If the iron-bearing minerals could be removed by improved methods of washing, by magnetic separation, or by sieving, a grade of glass-sand superior to the best Pennsylvania sand would be obtained. Mr. J. Volney Lewis gives the results of his investigations of the petrography of the trap rocks and of the origin of the copper ores commonly found in proximity to them. The view put forward that the copper

ores are deposits from ascending magmatic waters expelled from the great intrusive mass in the vicinity appears to be well supported by facts. Lastly, a record is given of tests of the resisting qualities of the trap as determined by a series of experiments carried out in cooperation with the Department of Agriculture. As the trap rocks are extensively used for road metal, these tests of their wearing qualities should prove of value when considered with regard to the results already shown by actual use.

A COLOURED supplement to the December number of the *Quarry* conveys an admirable impression of the appearance of the green marble now being quarried on the island of Iona. The marble occurs in gneiss of pre-Cambrian age as a well-defined vein, and its beautiful green colour is due to the presence of serpentine derived from forsterite by hydration.

AN important contribution to the study of weathering phenomena in building stones is afforded by a paper by Mr. E. Kaiser on the Stuben sandstone of Wurttemberg in the *Neues Jahrbuch für Mineralogie* (1907, ii., pp. 42-64). This stone was largely used in 1842 to 1868 on Cologne Cathedral, and now exhibits marked disintegration, the weathered material showing an external layer of scale, and below it a layer of soluble calcium and magnesium sulphates. In the quarry, on the other hand, the weathering consists in solution of the calcium and magnesium constituents of the brown spar in the rock with deposition of the iron as hydrated ferric oxide. It is evident that the disintegration in Cologne is caused by sulphur derived from smoke gases.

A DETAILED account has been published by Mr. N. W. Lord (United States Geological Survey, Bulletin No. 323) of the experimental work conducted in the chemical laboratory of the United States fuel-testing plant, St. Louis, between January 1, 1905, and July 31, 1906. Interesting results have been obtained in the determinations of specific gravities of coal, in laboratory methods of determining the adaptability of coals to improvement by washing, and in the estimation of volatile matter in coals and lignites. It is shown that the value obtained for volatile matter in coal is affected by the method of heating the sample, by the fineness of pulverisation, and by the amount of loosely held moisture present.

THE question of the concentration of ores is one to which much attention has recently been devoted, and inventors have been busy in the new field of flotation processes in which the concentrate is removed from the top and the tailings from the bottom, apparently in contravention of the law of gravity. A new process invented by Mr. A. P. Macquisten, and successfully applied in the United States, is described in the *Engineer* of December 13. It is based on the utilisation of the surface tension of liquids, it having been found that sulphide ores possess some property that prevents them from becoming wetted, whilst gangue minerals do not possess this property, and readily sink. At the Adelaide mine, Nevada, the process has been applied to copper pyrites, iron pyrites, blende, and galena with heavy gangue minerals, the presence of which rendered ordinary methods of concentration ineffective.

WE have received from Dr. Van Rijckevorsel parts iii. and iv. of his laborious investigation entitled "Constantly Recurring Secondary Maxima and Minima in the Yearly Range of Meteorological Phenomena." For details as to the methods employed we would refer our readers to the

notice of part ii., relating to temperature (NATURE, vol. lxxiii., p. 594), where it is explained that the author claims that the observations over the whole earth, collectively, and in the northern and southern hemispheres, separately, show half-yearly and other periods the epochs of which are identical. Part iii. deals with barometric pressure, for which 2755 years of observations are used, but are necessarily very unevenly distributed, 2255 years being to the north of the tropics, and only 381 years to the south. The similarity between the curves for the north and south hemispheres is not so pronounced as in the case of the temperature curves, as the years available for the south are altogether insufficient for the purpose, but the author thinks that with sufficient materials the results would probably be nearly identical. The results with regard to rainfall are much less satisfactory; the elimination of disturbances caused by heavy downpours in thunderstorms requires a much longer period of observation than is at present available. The paper is accompanied by tables and curves showing the variations exhibited by both elements.

THE foundations of geometry form the subject of the presidential address to section iii. of the Royal Society of Canada, by Prof. Alfred Baker, published in the Transactions of the society, 1906-7. The author traces the history of the axiom of parallels from an anecdote about Lagrange, and from the early writings on the subject of Gauss, Bolyai, and Lobachevski, and he gives a detailed abstract of Hilbert's assumptions. Referring to an attempt made in 1570 by Sir Henry Savile, of Oxford, to stimulate interest in Greek geometry by explaining the first eight propositions of Euclid to a class of university students, and comparing this result with the performance of modern schoolboys, Prof. Baker thinks that a time may come when schoolboys will find no difficulty with the abstractions of Hilbert's geometry, and the truth of Prof. Halsted's claim may be felt that "geometry at last made rigorous is also thereby made more simple."

THE August Bulletin of the Bureau of Standards of Washington contains a detailed comparison of the four most accurate methods of comparing the capacities of condensers, from the pen of Mr. F. W. Grover. He finds that the four are about equal in accuracy when the various sources of error inherent in each method are eliminated. He advocates the use of an auxiliary adjustable air condenser to enable comparisons to be made by the method of substitution, and shows that the power factor can readily be determined at the same time. This quantity gives valuable information as to the quality of the condenser, the absorption, and the change of capacity of the condenser with frequency.

M. CHARLES FÉRY has constructed a very simple calorimeter for determining the calorific power of gases and liquids, and gives a description of it in the November number of the *Journal de Physique*. The combustion is effected at the base of a glass chimney, the top of which supports a nickel plate pierced with a number of holes. The air necessary for combustion passes down a similar chimney, which is connected at its base with the former. The two junctions of a constantan-copper thermo-circuit are placed at the tops of the chimneys, and M. Féry finds that the electromotive force in the circuit is strictly proportional to the calorific power of the combustible and to the volume of it consumed in unit time.

MESSRS. BEMROSE AND SONS, LTD., have published the twelfth volume of the new series of the *Reliquary and Illustrated Archaeologist*, which contains the quarterly numbers of the review published during 1907. The separate

issues have been referred to from time to time in these columns. It will suffice to state here that the review is now edited by the Rev. Dr. J. Charles Cox, and is devoted to the study of the early Pagan and Christian antiquities of Great Britain, the development of the arts and industries of man in past ages, to the survival of ancient usages, and kindred subjects. The price of the volume is 12s. net.

OUR ASTRONOMICAL COLUMN.

NOVA PERSEI, 1901.—To test the question of possible proper motion in Nova Persei (No. 2), Prof. Barnard has recently repeated his measures of the Nova's position in regard to other stars in the neighbourhood, using the 40-inch refractor of the Yerkes Observatory. Comparing the results with those obtained in 1901-2, he finds no evidence of measurable motion. The present magnitude of the Nova is about 11.6, the star having apparently increased somewhat in brightness of late (*Astronomische Nachrichten*, No. 4220, p. 323, December 12).

PROVISIONAL ELEMENTS FOR THE SPECTROSCOPIC BINARY α ANDROMEDÆ.—In No. 4220 of the *Astronomische Nachrichten* (p. 327, December 12), Dr. H. Ludendorff publishes a provisional set of elements for the orbit of α Andromedæ, which star has been announced, by several observers, as a spectroscopic binary. This following set of elements has been calculated from the measurements of thirty-eight plates:—

$$\begin{array}{ll} U = 97^{\circ} \text{ o.d.} & \infty = 70^{\circ} \\ V = -14 \text{ km.} & e = 0.4 \\ A = 34 \text{ km. } B = 26 \text{ km.} & T = 1904 \text{ Dec. } 2 \\ u_1 = 98^{\circ} & a \sin i = 36,000,000 \text{ km.} \end{array}$$

PHOTOGRAPHS OF MARS.—The second of Prof. Lowell's series of articles on Mars, which is appearing in the *Century Magazine*, is published in the December number (vol. lxxv., No. 2, p. 303). In it the author gives an account of the inauguration and the work of, and of the results obtained by, the Lowell-Todd expedition to the Andes for the observation of Mars under conditions which could not be obtained in higher latitudes and less favourable climates. One of the reproductions illustrating the article shows the Amherst telescope in position at Alianza, Chile, surrounded by the members of the expedition; five other reproductions show prints from some of the plates obtained, each plate containing from sixty to ninety images of the planets, and, alongside, drawings made at the same time by Prof. Lowell, located some 6000 miles away, show how faithfully the photographs confirm the visual observations made at the Lowell Observatory. On the best series of photographs, obtained on July 25, are to be seen delicate canaliform markings which entirely refute the suggestions that such markings, previously recorded visually, are merely subjective phenomena.

Prof. Lowell states that the results greatly exceed his most sanguine expectations, and concludes his article with the following paragraph:—"That life is there is founded on no assumption, but on massed evidence that is conclusive, and the reader should realise that opposition to the idea that we now have proof of life on Mars is not based on reason, but on emotion, however speciously cloaked. All scientific objections have been met and shown untenable as to temperature, snow, &c., but human prejudice, as with the Copernican system or the origin of species, time alone can dispel."

SATURN APPARENTLY WITHOUT RINGS.—In the December *Bulletin de la Société astronomique de France* (p. 513) M. Flammarion discusses the recent observations of Saturn, paying particular attention to the phenomenon of bright knots, observed by Prof. Campbell, and confirmed by Prof. Lowell and others. In this connection he reproduces two drawings made by Bond showing "breaks and prominences" on October 28 and November 3, 1848. These interruptions in the light of the ring were then so easily seen that the observer did not hesitate to explain the phenomenon by the light reflected from the interior edges of the rings.